SB761
U7N6
no. 73-12

INSECT DISEASE REPORT

USDA FOREST SERVICE/NORTHERN REGION

Report No. 73-12

5200
April 1973

A PINE BUTTERFLY IMPACT SURVEY ON THE BITTERROOT NATIONAL FOREST AND STATE OF MONTANA LANDS - 1972

by

Jerald E. Dewey[1/], Hubert E. Meyer[2/]
Rudolph C. Lood[2/], and Steve Kohler[3/]

INTRODUCTION

The pine butterfly, *Neophasia menapia* (Felder and Felder), currently is epidemic on approximately 40,000 acres of State, private, and National Forest land in the Bitter Root Valley. Butterfly populations were reported as becoming epidemic in 1969 and have continually increased to the present level (Bousfield and Dewey 1972).

Because this is the first documented pine butterfly outbreak in Montana, we are uncertain how damaging it might be before it subsides. Two studies in southern and central Idaho have measured the impact of pine butterfly outbreaks on mature ponderosa pine. Both studies were rather limited in their scope.

Cole (1966) studied an outbreak that began in 1950 and was successfully controlled by aerial spraying in 1954. He made growth measurements on 40 trees ranging from 16 to 42 inches in diameter. Because of the spraying, very little tree mortality occurred following the infestation.

1/ Entomologist, USDA Forest Service, Region 1, Division of State and Private Forestry, Missoula, Montana.
2/ Biological technician, USDA Forest Service, Region 1, Division of State and Private Forestry, Missoula, Montana.
3/ Entomologist, Department of Natural Resources and Conservation, Division of Forestry, State of Montana, Missoula, Montana.

LIBRARY COPY
ROCKY MTN. FOREST & RANGE
EXPERIMENT STATION

Three of his study trees died as a result of bark beetle attack. Though tree mortality was not excessive as a result of the infestation, radial growth was severely affected. The study showed "defoliation caused reduction of growth by 39.34 percent of the estimated normal growth increment." This was interpreted as a loss of over 72 board feet per acre for that area.

Another outbreak that reached its peak in 1922 was studied by Evenden (1940). This infestation was allowed to run its course and subsided in 1923. During the study, 100 mature trees of various diameters and heights were marked and followed for 13 years. During this period 26 trees died, 14 following subsequent attack by the western pine beetle, *Dendroctonus brevicomis* Lec. Evenden found that radial growth was greatly affected by the outbreak. He observed 89 percent of his study trees failed to add any basal increment for periods varying from 1 to 11 years, with an average of 2.6 years. Increment reduction of over 70 percent was attributed to the defoliation.

In the fall of 1972, a survey was initiated in the Bitter Root Valley to measure the impact of the current infestation on the timber resource. The specific objectives of the survey are:

1. Determine the extent of tree mortality resulting from the outbreak.

2. Measure the effect of the outbreak on radial growth of surviving trees.

Though pine butterfly infestations have impacts on many resources (recreation, range, watersheds, etc.), only the timber resource was studied in this survey because these values are most readily quantified.

METHODS

The infested area was stratified into levels of defoliation (light, moderate, heavy) by sketch mapping from the air. Light was defined as areas of barely visible discoloration; moderate was conspicuous discoloration; and heavy areas were those where a distinct browning occurred and the bole of the tree was apparent.

About 15 areas of more than 150 acres were mapped as heavily defoliated throughout the infestation. Eight were on U.S. Forest Service or State of Montana land and offered good access. Each of these were selected as sampling areas (fig. 1). In addition, five moderately defoliated areas of at least 150 acres were selected for sampling.

Survey lines were established at 10-chain intervals in each study area. Plots were located every 5 chains along these lines. Sample trees were selected using an angle gauge of BAF 20. Sample trees were those of all species, 5 inches or greater d.b.h. Each sample tree was

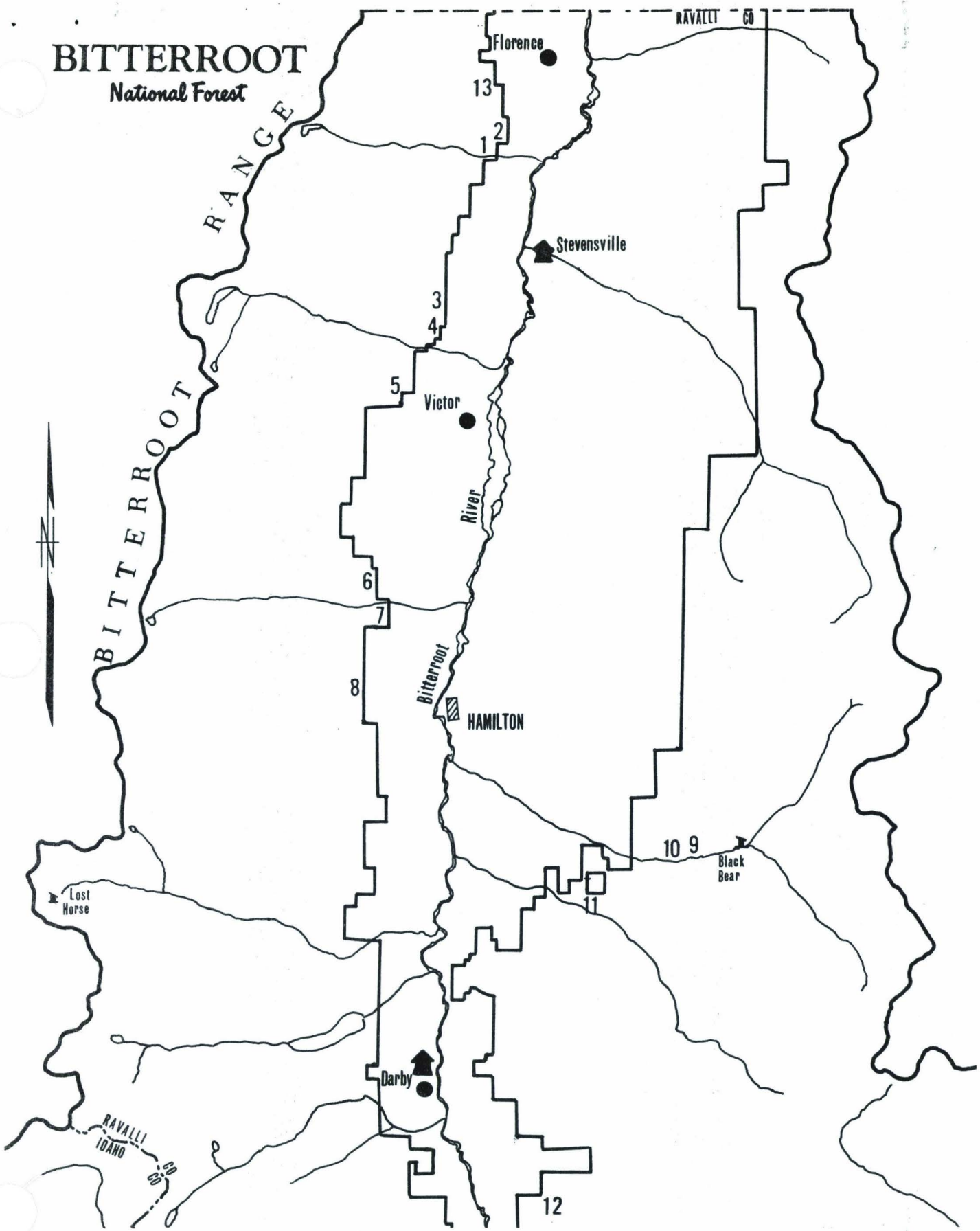

Figure 1.--Approximate locations of survey areas.

permanently numbered and the plot center marked. Each survey line and plot were recorded on aerial photos to assist in relocating plots.

The following data was collected at each plot and entered on the modified sales cruise tally sheet (form R1-2430-30):

1. Habitat type of plot
2. Species of each sample tree
3. D.b.h. of each sample tree
4. Height of each sample tree
5. Condition of each ponderosa pine sample tree

Tree condition was defined as one of the following categories:

Negligible defoliation (0) - green, no visible defoliation.

Light defoliation (1) - less than one-half of old foliage removed with new growth intact.

Moderate defoliation (2) - more than one-half of old foliage removed with new growth intact.

Heavy defoliation (3) - most of old foliage removed, and less than one-half of new growth destroyed.

Severe defoliation (4) - most of old foliage removed and more than one-half of new growth destroyed.

Killed by bark beetles (5) - tree was dead and infested with bark beetles.

Killed, miscellaneous (6) - tree was dead and not infested with bark beetles.

Survey lines were continued in each area until 30 plots were established or the entire area surveyed. An exception was area 13 where 90 plots were established because the State of Montana wanted a complete survey of this area.

The effect of the outbreak on radial growth will be measured by using breast height increment cores. Cores will be taken from a given number of sample trees in the fall of 1977 (5 years after most areas were defoliated). Radial growth will be measured for the 10-year period preceding the outbreak (1961-1971). From this an estimate of the expected radial growth for the following 5 years (1972-1977) will be obtained by using the Region's Stage II computer program. The difference in growth rates from the expected and actual will be attributed to pine butterfly defoliation. A sample of cores from nonhost trees on the plots will be used to check for growth changes due to nonbutterfly factors (precipitation, etc.). Additional cores may be taken periodically beyond the 5-year defoliation period to determine how long the effect on growth

persists. Evenden (1940) reports radial growth was retarded for as long as 13 years following a pine butterfly outbreak in Idaho.

To measure the impact of the infestation on regeneration, plots have been established in five areas of heavy defoliation. At each plot 30 trees were permanently marked and their condition will be followed throughout the duration of the outbreak. Ten trees of the following size classes were measured at each plot:

1 - less than 5 feet tall
2 - 5 to 10 feet tall
3 - 10 to 20 feet tall

Plots will be re-examined for at least 5 years beyond the end of the outbreak. The data will be ADP processed.

RESULTS

The first year of the survey was designed to establish the plots and document the condition of the study trees.

There were 266 plots established on 1,330 acres in the eight areas of heavy defoliation. Measurements were taken on 690 trees of which 604 were ponderosa pine. Diameters at breast height ranged from 5 to 57 inches. In the areas of moderate defoliation, 146 plots were established and 363 trees examined of which 312 were ponderosa pine.

Summaries of the current stand conditions are shown in tables 1 and 2. Area-by-area summaries are shown in appendixes I and II.

Table 1.--Summary of heavily defoliated stand condition

Tree condition class	Average d.b.h. (inches)	Trees/acre (5+ inches d.b.h.)	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
Negligible defoliation (0)	10	9.5	659	14.3	12.3
Light defoliation (1)	11	.9	52	1.4	1.0
Moderate defoliation (2)	9	10.1	443	15.2	8.3
Heavy defoliation (3)	11	25.0	1,847	37.7	34.6
Severe defoliation (4)	12	19.6	2,320	29.6	43.5
Killed by bark beetles (5)	7	1.3	10	2.0	.2
Killed, miscellaneous (6)	26	0	6	0	.1
Total		66.4	5,337		

Table 2.--Summary of moderately defoliated stand condition

Tree condition class	Average d.b.h. (inches)	Trees/acre (5+ inches d.b.h.)	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
Negligible defoliation (0)	11	9.6	649	13.9	14.2
Light defoliation (1)	9	24.3	955	35.1	20.9
Moderate defoliation (2)	11	24.5	1,863	35.4	40.9
Heavy defoliation (3)	12	9.9	993	14.3	21.8
Severe defoliation (4)	14	.9	99	1.3	2.2
Killed by bark beetles (5)	0	0	0	0	0
Killed, miscellaneous (6)	0	0	0	0	0
Total		69.2	4,559		

DISCUSSION AND CONCLUSIONS

To date the pine butterfly outbreak has not been excessively damaging on the timber resource in terms of tree mortality or reduced radial growth. However, based on past outbreaks, tree mortality and retarded growth should not occur until the summer of 1973. Most trees have sufficient food reserves stored to continue the normal growth processes for 1 or 2 years after being heavily defoliated.

Even the most heavily defoliated trees went into winter dormancy alive. Close observation should be made in the spring to see if these weakened trees can survive the physiological stresses of new foliage growth.

The most severe damage appears to be on the most harsh sites. The dry, south-facing slopes are the most heavily defoliated. The overall stocking of both the moderately and heavily defoliated areas was low (69 and 66 trees per acre respectively).

LITERATURE CITED

Bousfield, Wayne E., and Jerald E. Dewey, 1972. An evaluation of the pine butterfly outbreak in the Bitterroot and Missoula area. USDA Forest Serv., Northern Region, Div. of State and Priv. Forestry, Missoula, MT 59801, Report No. I-72-12.

Cole, Walter E., 1966. Effect of pine butterfly defoliation on ponderosa pine in southern Idaho. USDA Forest Serv., Intermtn. Forest and Range Expt. Sta., Ogden, UT 84401, Research Note INT-46.

Evenden, J. C., 1940. Effects of defoliation by the pine butterfly upon ponderosa pine. J. Forestry 38: 949-55.

APPENDIX I

Stand Condition by Area (Heavy Defoliation)

Area No. and name	Tree condition	Average d.b.h. (inches)	Trees/ acre*	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
1-Bass Cr.	0	12	8.4	855	18.3	28.5
	1	--	--	--	--	--
	2	9	8.7	121	19.0	4.0
	3	9	19.3	798	42.1	26.6
	4	14	9.4	1,230	20.6	40.9
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		45.8	3,004		
3-McCalla Cr.	0	14	14.6	1,564	15.5	26.6
	1	--	--	--	--	--
	2	8	35.1	892	37.2	15.2
	3	15	12.7	2,122	13.5	36.1
	4	8	32.0	1,300	33.9	22.1
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		94.8	5,878		
4-St. Mary's Creek	0	9	16.5	419	20.8	10.8
	1	9	1.5	--	1.9	--
	2	7	9.1	100	11.5	2.6
	3	8	40.9	1,332	51.6	34.2
	4	16	11.2	2,039	14.1	52.4
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		79.2	3,890		
5-Smith Cr.	0	10	14.3	850	24.8	23.7
	1	19	.3	62	.5	1.7
	2	11	19.6	1,225	34.0	34.2
	3	11	17.1	1,170	29.6	32.6
	4	11	6.4	280	11.1	7.8
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		57.7	3,587		

*Only trees of 5 or more inches d.b.h.

APPENDIX I

Stand Condition by Area (Heavy Defoliation), con.

Area No. and name	Tree condition	Average d.b.h. (inches)	Trees/ acre*	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
6-Cow Cr.	0	12	6.5	388	9.1	15.0
	1	11	2.5	12	3.5	.5
	2	10	18.5	333	25.8	12.9
	3	9	25.9	629	36.1	24.3
	4	10	18.4	1,223	25.6	47.3
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		71.8	2,585		
8-Canyon Cr.	0	9	29.4	1,949	68.1	22.2
	1	8	1.9	--	4.9	1.0
	2	24	.2	56	.5	.6
	3	16	4.3	1,546	10.0	17.6
	4	23	6.9	5,094	16.0	58.0
	5	--	--	--	--	--
	6	26	.3	52	.8	.6
	Total		43.2	8,784		
10-Skalkaho Creek	0	17	3.1	679	9.0	10.2
	1	15	1.5	208	4.4	3.1
	2	12	6.5	284	19.0	4.3
	3	15	16.3	2,814	47.5	42.4
	4	19	6.9	2,648	20.1	39.9
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		34.3	6,633		
13-Sweeney Creek	0	11	.9	38	1.1	.6
	1	17	.4	63	1.5	1.1
	2	11	7.3	531	8.6	9.1
	3	11	35.7	2,477	42.1	42.2
	4	11	36.7	2,729	43.3	46.5
	5	7	3.8	28	4.5	.5
	6	--	--	--	--	--
	Total		84.8	5,866		

*Only trees of 5 or more inches d.b.h.

APPENDIX II

Stand Condition by Area (Moderate Defoliation)

Area No. and name	Tree condition	Average d.b.h. (inches)	Trees/ acre*	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
2-Larry Cr.	0	9	3.0	101	3.0	2.7
	1	9	32.2	661	32.6	17.4
	2	9	38.8	1,071	39.5	28.1
	3	11	24.0	1,746	24.4	45.9
	4	15	1.7	228	1.7	6.0
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		98.2	3,807		
7-Mill Cr.	0	13	20.4	1,921	21.0	34.8
	1	11	23.6	966	24.3	17.5
	2	11	39.2	1,987	40.3	36.0
	3	10	13.3	589	13.7	10.7
	4	12	.8	63	.8	1.1
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		97.3	5,526		
9-Tenderfoot Creek	0	8	27.5	803	56.9	10.7
	1	11	14.9	2,225	30.8	29.7
	2	24	5.1	3,943	10.6	52.5
	3	27	.8	533	1.7	7.1
	4	--	--	--	--	--
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		48.3	7,504		
11-Sleeping Child Cr.	0	23	.4	263	.9	5.4
	1	9	26.2	566	57.0	11.6
	2	14	10.9	2,089	23.7	43.0
	3	16	6.7	1,749	14.6	36.0
	4	13	1.8	192	3.9	4.0
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		46.0	4,859		

*Only trees of 5 or more inches d.b.h.

APPENDIX II

Stand Condition by Area (Moderate Defoliation), con.

Area No. and name	Tree condition	Average d.b.h. (inches)	Trees/ acre*	Volume/acre (bd. ft.)	Percent of stand	Percent of volume
12-Robinson Creek	0	8	10.9	176	17.1	11.8
	1	9	23.5	527	36.8	35.3
	2	9	25.9	500	40.6	33.5
	3	12	3.5	288	5.5	19.3
	4	--	--	--	--	--
	5	--	--	--	--	--
	6	--	--	--	--	--
	Total		63.8	1,491		

*Only trees of 5 or more inches d.b.h.